

What is claimed is:

1. A computer program product for sending Transmission Control Protocol (TCP) messages through HyperText Transfer Protocol (HTTP) systems, the computer program product embodied on one or more computer-readable media and comprising:

computer-readable program code means for establishing a send channel from a first component on a client side of a network connection, through one or more HTTP-based systems, to a second component on a remote side of the network connection;

computer-readable program code means for establishing a receive channel from the first component, through the one or more HTTP-based systems, to the second component;

computer-readable program code means for establishing a first TCP connection from a client on the client side to the first component;

computer-readable program code means for establishing a second TCP connection from the second component to a target server on the remote side;

computer-readable program code means for transmitting client-initiated TCP requests from the client to the target server on the send channel; and

computer-readable program code means for transmitting server-initiated TCP requests from the target server to the client on the receive channel.

2. The computer program product according to Claim 1, wherein the computer-readable program code means for transmitting client-initiated TCP requests further comprises:

computer-readable program code means for receiving a client-initiated TCP request from the client at the first component on the first TCP connection;

5 computer-readable program code means for packaging the received client-initiated TCP  
6 request in an HTTP POST request message;

7 computer-readable program code means for sending the HTTP POST request message to  
8 the second component on the network connection;

9 computer-readable program code means for receiving the sent HTTP POST request  
10 message at the second component;

11 computer-readable program code means for extracting the client-initiated TCP request  
12 from the received HTTP POST request message; and

13 computer-readable program code means for forwarding the extracted client-initiated TCP  
14 request to the target server on the second TCP connection.

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7 first component; and

8 computer-readable program code means for closing the send channel, responsive to  
9 operation of the computer-readable program code means for receiving the HTTP POST response.

1 5. The computer program product according to Claim 1, wherein the computer-readable  
2 program code means for transmitting server-initiated TCP requests further comprises:

3 computer-readable program code means for sending an HTTP GET request message from  
4 the first component to the second component on the network connection;

5 computer-readable program code means for receiving the sent HTTP GET request  
6 message at the second component;

7 computer-readable program code means for receiving a server-initiated TCP request from  
8 the target server at the second component on the second TCP connection;

9 computer-readable program code means for packaging the received server-initiated TCP  
10 request in an HTTP GET response message which acknowledges the received HTTP GET  
11 request message;

12 computer-readable program code means for sending the HTTP GET response message  
13 from the second component to the first component on the network connection;

14 computer-readable program code means for receiving the sent HTTP GET response  
15 message at the first component;

16 computer-readable program code means for extracting the server-initiated TCP request  
17 from the received HTTP GET response message; and

18 computer-readable program code means for forwarding the extracted server-initiated TCP

request to the client on the first TCP connection.

6. The computer program product according to Claim 5, wherein the computer-readable program code means for transmitting server-initiated TCP requests further comprises:

computer-readable program code means for performing a read operation on the second TCP connection, responsive to operation of the computer-readable program code means for receiving the sent HTTP GET request message and prior to operation of the computer-readable program code means for receiving the server-initiated TCP request; and

computer-readable program code means for using the received server-initiated TCP request as a result of the read operation, thereby triggering operation of the computer-readable program code means for packaging the received server-initiated TCP request in the HTTP GET response message.

7. The computer program product according to Claim 5, wherein the computer-readable program code means for transmitting server-initiated TCP requests further comprises computer-readable program code means for preparing to receive another server-initiated TCP request by triggering operation of the computer-readable program code means for sending the HTTP GET request message from the first component to the second component, responsive to operation of the computer-readable program code means for receiving the sent HTTP GET response message at the first component.

8. The computer program product according to Claim 2, wherein a Multi-Purpose Internet

2 Mail Extensions (MIME) type of the HTTP POST request message is set to "binary/tcp".

1 9. The computer program product according to Claim 5, wherein a Multi-Purpose Internet

2 Mail Extensions (MIME) type of the HTTP GET request message is set to "binary/tcp".

1 10. A system for sending Transmission Control Protocol (TCP) messages through HyperText  
2 Transfer Protocol (HTTP) systems, comprising:

3 means for establishing a send channel from a first component on a client side of a network  
4 connection, through one or more HTTP-based systems, to a second component on a remote side  
of the network connection;

5 means for establishing a receive channel from the first component, through the one or  
6 more HTTP-based systems, to the second component;

7 means for establishing a first TCP connection from a client on the client side to the first  
8 component;

9 means for establishing a second TCP connection from the second component to a target  
10 server on the remote side;

11 means for transmitting client-initiated TCP requests from the client to the target server on  
12 the send channel; and

13 means for transmitting server-initiated TCP requests from the target server to the client on  
14 the receive channel.  
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1 11. The system according to Claim 10, wherein the means for transmitting client-initiated TCP

2 requests further comprises:

3 means for receiving a client-initiated TCP request from the client at the first component on  
4 the first TCP connection;

5 means for packaging the received client-initiated TCP request in an HTTP POST request  
6 message;

7 means for sending the HTTP POST request message to the second component on the  
8 network connection;

9 means for receiving the sent HTTP POST request message at the second component;

10 means for extracting the client-initiated TCP request from the received HTTP POST  
11 request message; and

12 means for forwarding the extracted client-initiated TCP request to the target server on the  
13 second TCP connection.

12. The system according to Claim 11, wherein the means for transmitting client-initiated TCP  
requests further comprises means for acknowledging the HTTP POST request by sending an  
HTTP POST response from the second component to the first component on the network  
4 connection.

1 13. The system according to Claim 12, wherein the means for establishing the send channel  
2 operates in response to the means for receiving the client-initiated TCP request, and wherein the  
3 means for transmitting client-initiated TCP requests further comprises:

4 means for receiving the HTTP POST response at the first component; and

5 means for closing the send channel, responsive to operation of the means for receiving the  
6 HTTP POST response.

1 14. The system according to Claim 10, wherein the means for transmitting server-initiated  
2 TCP requests further comprises:

3 means for sending an HTTP GET request message from the first component to the second  
4 component on the network connection;

5 means for receiving the sent HTTP GET request message at the second component;

6 means for receiving a server-initiated TCP request from the target server at the second  
7 component on the second TCP connection;

8 means for packaging the received server-initiated TCP request in an HTTP GET response  
9 message which acknowledges the received HTTP GET request message;

10 means for sending the HTTP GET response message from the second component to the  
11 first component on the network connection;

12 means for receiving the sent HTTP GET response message at the first component;

13 means for extracting the server-initiated TCP request from the received HTTP GET  
14 response message; and

15 means for forwarding the extracted server-initiated TCP request to the client on the first  
16 TCP connection.

1 15. The system according to Claim 14, wherein the means for transmitting server-initiated  
2 TCP requests further comprises:

3 means for performing a read operation on the second TCP connection, responsive to  
4 operation of the means for receiving the sent HTTP GET request message and prior to operation  
5 of the means for receiving the server-initiated TCP request; and

6 means for using the received server-initiated TCP request as a result of the read operation,  
7 thereby triggering operation of the means for packaging the received server-initiated TCP request  
8 in the HTTP GET response message.

1 16. The system according to Claim 14, wherein the means for transmitting server-initiated  
2 TCP requests further comprises means for preparing to receive another server-initiated TCP  
3 request by triggering operation of the means for sending the HTTP GET request message from  
4 the first component to the second component, responsive to operation of the means for receiving  
5 the sent HTTP GET response message at the first component.

6 17. The system according to Claim 11, wherein a Multi-Purpose Internet Mail Extensions  
7 (MIME) type of the HTTP POST request message is set to "binary/tcp".

1 18. The system according to Claim 14, wherein a Multi-Purpose Internet Mail Extensions  
2 (MIME) type of the HTTP GET request message is set to "binary/tcp".

1 19. A method for sending Transmission Control Protocol (TCP) messages through HyperText  
2 Transfer Protocol (HTTP) systems, comprising the steps of:

3 establishing a send channel from a first component on a client side of a network



4 connection, through one or more HTTP-based systems, to a second component on a remote side  
5 of the network connection;

6 establishing a receive channel from the first component, through the one or more HTTP-  
7 based systems, to the second component;

8 establishing a first TCP connection from a client on the client side to the first component;

9 establishing a second TCP connection from the second component to a target server on  
10 the remote side;

11 transmitting client-initiated TCP requests from the client to the target server on the send  
12 channel; and

13 transmitting server-initiated TCP requests from the target server to the client on the  
14 receive channel.

20. The method according to Claim 19, wherein the step of transmitting client-initiated TCP  
requests further comprises the steps of:

1 receiving a client-initiated TCP request from the client at the first component on the first  
2 TCP connection;

3 packaging the received client-initiated TCP request in an HTTP POST request message;

4 sending the HTTP POST request message to the second component on the network  
5 connection;

6 receiving the sent HTTP POST request message at the second component;

7 extracting the client-initiated TCP request from the received HTTP POST request  
8 message; and  
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11 forwarding the extracted client-initiated TCP request to the target server on the second  
12 TCP connection.

1 21. The method according to Claim 20, wherein the step of transmitting client-initiated TCP  
2 requests further comprises the step of acknowledging the HTTP POST request by sending an  
3 HTTP POST response from the second component to the first component on the network  
4 connection.

1 22. The method according to Claim 21, wherein the step of establishing the send channel  
2 operates in response to the step of receiving the client-initiated TCP request, and wherein the step  
3 of transmitting client-initiated TCP requests further comprises the steps of:

4 receiving the HTTP POST response at the first component; and

5 closing the send channel, responsive to receiving the HTTP POST response.

6 23. The method according to Claim 19, wherein the step of transmitting server-initiated TCP  
7 requests further comprises the steps of:

8 sending an HTTP GET request message from the first component to the second  
9 component on the network connection;

10 receiving the sent HTTP GET request message at the second component;

11 receiving a server-initiated TCP request from the target server at the second component  
12 on the second TCP connection;

13 packaging the received server-initiated TCP request in an HTTP GET response message

9 which acknowledges the received HTTP GET request message;  
10 sending the HTTP GET response message from the second component to the first  
11 component on the network connection;  
12 receiving the sent HTTP GET response message at the first component;  
13 extracting the server-initiated TCP request from the received HTTP GET response  
14 message; and  
15 forwarding the extracted server-initiated TCP request to the client on the first TCP  
16 connection.

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24. The method according to Claim 23, wherein the step of transmitting server-initiated TCP requests further comprises the steps of:

performing a read operation on the second TCP connection, responsive to receiving the sent HTTP GET request message and prior to receiving the server-initiated TCP request; and

using the received server-initiated TCP request as a result of the read operation, thereby triggering the step of packaging the received server-initiated TCP request in the HTTP GET response message.

25. The method according to Claim 23, wherein the step of transmitting server-initiated TCP requests further comprises the step of preparing to receive another server-initiated TCP request by triggering the step of sending the HTTP GET request message from the first component to the second component, responsive to receiving the sent HTTP GET response message at the first component.

1 26. The method according to Claim 20, wherein a Multi-Purpose Internet Mail Extensions  
2 (MIME) type of the HTTP POST request message is set to "binary/tcp".

1 27. The method according to Claim 23, wherein a Multi-Purpose Internet Mail Extensions  
2 (MIME) type of the HTTP GET request message is set to "binary/tcp".

1 28. A method for transporting bi-directional protocol traffic through uni-directional protocol  
2 systems, comprising the steps of:

3 establishing a send channel from a first component on a client side of a network  
4 connection, through one or more uni-directional protocol-based systems, to a second component  
5 on a remote side of the network connection;

6 establishing a receive channel from the first component, through the one or more uni-  
7 directional protocol-based systems, to the second component;

8 establishing a first bi-directional protocol connection from a client on the client side to the  
9 first component;

10 establishing a second bi-directional protocol connection from the second component to a  
11 target server on the remote side;

12 transmitting client-initiated bi-directional protocol requests from the client to the target  
13 server on the send channel; and

14 transmitting server-initiated bi-directional protocol requests from the target server to the  
15 client on the receive channel.

1 29. The method according to Claim 28, wherein the step of transmitting client-initiated bi-  
2 directional protocol requests further comprises the steps of:

3 receiving a client-initiated bi-directional protocol request from the client at the first  
4 component on the first bi-directional protocol connection;

5 packaging the received client-initiated bi-directional protocol request in a uni-directional  
6 protocol write request message;

7 sending the uni-directional protocol write request message to the second component on  
8 the network connection;

9 receiving the sent uni-directional protocol write request message at the second  
10 component;

11 extracting the client-initiated bi-directional protocol request from the received uni-  
12 directional protocol write request message; and

13 forwarding the extracted client-initiated bi-directional protocol request to the target server  
14 on the second bi-directional protocol connection.

1 30. The method according to Claim 28, wherein the step of transmitting server-initiated bi-  
2 directional protocol requests further comprises the steps of:

3 sending a uni-directional protocol read request message from the first component to the  
4 second component on the network connection;

5 receiving the sent uni-directional protocol read request message at the second component;

6 receiving a server-initiated bi-directional protocol request from the target server at the

7 second component on the second bi-directional protocol connection;

8 packaging the received server-initiated bi-directional protocol request in a uni-directional  
9 protocol read response message which acknowledges the received uni-directional protocol read  
10 request message;

11 sending the uni-directional protocol read response message from the second component to  
12 the first component on the network connection;

13 receiving the sent uni-directional protocol read response message at the first component;

14 extracting the server-initiated bi-directional protocol request from the received uni-  
15 directional protocol read response message; and

16 forwarding the extracted server-initiated bi-directional protocol request to the client on the  
17 first bi-directional protocol connection.